

The Case for Including Adverse Childhood Experiences in Child Maltreatment Education: A Path Analysis

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Perm J 2018;22:17-122

E-pub:03/16/2018

<https://doi.org/10.7812/TPP/17-122>

ABSTRACT

Context: The lifelong, negative consequences of exposure to adverse childhood experiences (ACEs) for individuals and their families are well established.

Objective: To demonstrate the importance of including ACE information in child maltreatment education curricula using path analysis.

Design: Survey data examined the impact of child maltreatment education programs and knowledge about ACEs on medical practitioners' reporting habits and ability to detect maltreatment. A path diagram distinguished between the direct impact of education programs on outcome measures and the indirect effect that is mediated through knowledge of ACEs.

Main Outcome Measures: Medical practitioners' ability to detect child maltreatment and their number of referrals to Child Protective Services (CPS).

Results: The optimized path diagram ($\chi^2/SB(3) = 3.9, p = 0.27; RMSEA-SB = 0.017; R^2 = 0.21$, where SB is Satorra-Bentler coefficient and RMSEA is root-mean-square error of approximation) revealed the mediating variable "knowledge about ACEs" as the strongest structural effect ($SB-\beta = 0.34$) on the number of CPS referrals. It was almost twice as high as the second strongest effect of formal education programs ($SB-\beta = 0.19$). For workplace training programs, the total effect when including knowledge of ACEs was almost double as strong as the direct effect alone. Even when previous child maltreatment education was controlled for, practitioners familiar with the consequences of ACEs were significantly more likely to recognize and to report abuse to CPS.

Conclusion: This study documented the importance of specialized training programs on ACEs, and the essential role ACE knowledge plays in the effectiveness of provider education programs.

INTRODUCTION

Although health care professionals have acknowledged the need for trauma-informed care of patients,¹⁻⁴ few postgraduate educational programs have put in place training and examination modules on adverse childhood experiences (ACEs) knowledge, screening, and treatment of social determinants of health-related toxic stress. Certain specialties, including family medicine and primary care,^{3,5} psychiatry,⁶ and pediatrics,⁷⁻¹⁰ among others, have called for increased training in child maltreatment recognition and response. Few of these programs, however, have mandated continuing medical education (CME), undergraduate- or graduate-level courses, or clinical practicums that focus on ACEs and their long-term impact on health, screening, and treatment,^{3,11} despite

the fact that physicians have indicated they would like additional training in these competencies.¹¹

The trajectory of a person's lifelong physical, mental, and social health is set in early childhood, as demonstrated originally by the pioneering ACE Study¹² and the vast body of literature that followed. Children who are exposed to four or more categories of adverse experiences (including physical abuse; neglect; sexual abuse; emotional maltreatment; loss of a caregiver through divorce, death, or imprisonment; mental illness in a primary caregiver; exposure to domestic violence; and drug or alcohol abuse in the home), experience prolonged physiologic stress, which leads to neurodevelopmental, immunologic, and epigenetic maladaptations.^{12,13} Exposure to toxic stress alters an individual's threat

responsiveness, executive functioning, and propensity for risk-taking behavior,¹⁴ as well as elevating inflammation levels¹⁵ and altering immune response.¹⁶ Often, young people exposed to ACEs in their childhood experience early sexual debut^{17,18} and an increased risk of sexually transmitted infections (STIs),¹⁹ unintended and teenage pregnancy,^{20,21} substance abuse,^{19,22} mental health issues,^{18,19,23-26} and loss of educational and employment opportunities.^{27,28}

The effects of early exposure to toxic stress are not limited to psychosocial factors, however. Throughout their lifespan, these children are more likely to experience chronic obstructive pulmonary disease,²⁹ autoimmune disorders,¹⁶ cancer,³⁰ low birth weight and fetal death,³¹ and shorter life expectancy,³² among other poor outcomes.¹³ Exposure to ACEs, often amplified by violence in the home and the community,^{33,34} poverty,^{34,35} and social inequality,³⁶ clearly contributes to a sustained and intergenerational pattern of both psychosocial and physiologic maladaptations.¹⁰ Therefore, effective prevention of health and social inequities and their ensuing exposures to ACEs and toxic stress must merge risk mitigation across health and psychosocial domains.

A primary challenge facing professionals who interact with patient populations is finding at-risk children, ideally before they are harmed. As a hidden population, children from birth to age five years are often not yet in school, and some may not yet have a medical home.³⁷ Recent advances to predict locations of where maltreatment will occur offer a promising approach.³⁴ Nevertheless, detection of maltreatment incidents continues to rely in large part on reports made by professionals who interact with children.⁵ As one of the

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primary reporting agents, pediatric health care professionals are positioned to recognize early childhood adversity. Research, however, indicates that most pediatricians and pediatric residents are not aware of the ACE Study¹² or the pathophysiology of toxic stress, and they rarely screen their patient population for ACEs.³⁸⁻⁴⁰ Likewise, among nonpediatrician physicians, advanced practice providers, and medical service providers who care for children, ACE awareness also appears to be lacking in professional education, certification, and licensing domains.^{5,41} These professionals therefore must be trained to recognize sentinel injuries, common signs of child maltreatment, and elevated risk factors, such as ACEs. That capability will stem from an understanding of the pathophysiology of toxic stress and associated health and social conditions, as described by the original ACE Study¹² and ongoing research that seeks to elucidate the relationship between early childhood stress, maltreatment, and acute and chronic health conditions.^{13,42,43}

Recently, the Commission to Eliminate Child Abuse and Neglect Fatalities⁴⁴ made a policy statement on the importance of Child Protective Services (CPS) regularly communicating with at-risk children's health care providers and the impact this has on medical professionals' ability to protect children. Likewise, the American Academy of Pediatrics issued a policy statement that pediatricians should frequently screen patients and caregivers for ACEs,⁴² echoing researcher recommendations.⁴⁵ To add to this growing body of recommendations,⁴⁶ this study highlights the need for primary and continuing education of health care professionals from diverse fields regarding toxic stress and its pathophysiology, ACEs and their long-term impact on children and their caregivers, and the importance of early detection of child maltreatment. This training should ideally begin in undergraduate medical and nursing curricula, continue through medical school and residency, and persist throughout one's career in the form of CME credits. By recognizing the often long-lasting impact and intergenerational "ripple effect" of early ACE exposure on individuals, families, and communities, this study examined how professionals' knowledge of ACEs facilitated their

reporting habits and recognition of sentinel injuries. The present study employed path analysis to examine the comparative strength of the direct effect of child maltreatment-related training and the indirect effect mediated through awareness of ACEs on a practitioner's identification of injuries as maltreatment-caused, as well as their willingness to report cases.

METHODS

Data for this study were obtained from a pretraining survey that was administered as part of an institutional review board-exempt, child maltreatment-focused education program by a large North Central Texas children's health care provider. The training offered CME credits for any physician, physician assistant, psychologist, nurse practitioner, nurse, counselor, therapist, social worker, or educator employed by the network. It included virtual simulations of patient assessments and was focused on reporting mandates, clinical information, physical manifestations, and long-term outcomes of child maltreatment. Both the training and the pretraining survey were administered online through Qualtrics (Qualtrics

LLC Research Core, Provo, UT & Seattle, WA).⁴⁷ Completion of the pretraining survey was a requirement for all participants to receive CME credit. During roughly 2.5 years beginning in June 2014, a total of 1056 trainees completed the survey.

Exogenous Variables

Three main types of previously received professional training on child abuse and neglect issues—formal education/certification programs, continuing education courses, and workplace training programs—were entered as exogenous variables. Their direct and indirect, mediated effects on the endogenous variables were assessed as a path model. The number of years a respondent had been practicing, whether they had children of their own, and their sex were tested as additional exogenous control variables but were omitted from the optimized best-fit model because they failed to show any significant effects.

Endogenous Outcome Variables

Respondents' ability to identify or diagnose instances of child abuse and neglect and their willingness to report suspected cases of child maltreatment were assessed

Table 1a. Path model variables for practitioner study participants

Variable	Range	Mean/proportion	SD	N
Knowledge of ACEs	0-1	0.07	0.255	1056
Formal education in CM	0-1	0.09	0.279	1056
Continuing education in CM	0-1	0.15	0.355	1056
Workplace training in CM	0-1	0.26	0.439	1056
No. of CPS referrals	0-200	3.07	13.235	1056
Scenario score	1.78-5	3.86	0.495	1056

ACE = adverse childhood experience; CM = child maltreatment; CPS = Child Protective Services; SD = standard deviation.

Table 1b. Control and sociodemographic practitioner characteristics

Characteristic	Range	Mean/proportion	SD	N
Years' practice experience	0-45	11.45	9.668	1056
Knowledge how to report suspected CM	1-5	4.10	0.813	1056
Knowledge of responsibility to report suspected CM	1-5	4.65	0.636	1056
Parent				
Yes		0.66		695
No		0.34		361
Sex				
Male		0.16		168
Female		0.84		888

CM = child maltreatment; SD = standard deviation.

with 2 separate endogenous measures. First, trainees were asked to indicate the total number of cases they have referred to CPS (mean = 3.1, standard deviation [SD] = 13.24). Second, respondents were presented with a series of 9 clinical scenarios, all of which constituted instances of child maltreatment (see Sidebar: Clinical Scenarios for Testing Knowledge of Child Maltreatment). For each of these scenarios, respondents were asked to indicate their likelihoods of both suspecting child abuse and neglect, and reporting the case, on 5-point Likert scales (1 = definitely not suspect/report; 5 = definitely suspect/report). The values for all 9 scenarios were averaged for each person (mean = 3.86, SD = 0.49) and entered into the path diagram as the second dependent variable.

Mediating Variables

To test the importance of including the original ACE Study¹² for the effectiveness of pediatric practitioners' training curricula, the self-reported knowledge ("Are you familiar with the Adverse Childhood Experiences [ACE] Study?") was included as a mediating variable into the theoretical path model. The potential influence of 2 additional mediating variables, the respondent's self-reported 1) knowledge of how to report suspected child abuse and neglect and 2) responsibility to recognize and report child maltreatment as employees of a children's health care provider, were also tested to further isolate the effect of knowing about the ACE Study.¹² Both items were again assessed as 5-point Likert scales. The knowledge question had a mean of 4.1 (SD = 0.81), and the perceived responsibility yielded an average of 4.65 (SD = 0.64). As was the case for the other exogenous control variables, both constructs failed to show any significant effects and were therefore excluded from the final, optimized model.

Path Model and Statistical Analysis

The hypothesized mediational effect of being aware of the lifelong persistent, negative consequences of child abuse and neglect trauma revealed in the ACE Study¹² was tested by optimizing a theoretically derived, overidentified, hierarchical, and recursive covariance-based structural equation model (CB-SEM) in Stata 14

Table 2. Bivariate correlations of study variables in optimized path model

Variable		1	2	3	4	5	6
Knowledge of ACEs	1	—					
Formal education	2	0.25	—				
Continuing education	3	0.22	0.34	—			
Workplace training	4	0.20	0.28	0.39	—		
No. of CPS referrals	5	0.43	0.34	0.34	0.23	—	
Scenario score	6	0.12	0.15	0.10	0.08	0.12	—

ACE = adverse childhood experience; CPS = Child Protective Services.

IC 64 bit for Windows (StataCorp LLC, College Station, TX). Although the underlying maximum likelihood estimation (MLE) algorithm of parametric CB-SEMs typically assumes normality for all included variables, the Satorra-Bentler^{48,49} estimator for standard errors was used to compensate for the fact that most of the included variables did not meet the normality assumption.^{50,51} Correspondingly, the overall goodness-of-fit statistics were assessed through the more robust Satorra-Bentler scaled χ^2 statistic, rather than the standard χ^2 test.^{48,49} Beyond χ^2 , this more conservative adjustment also increases the robustness of standard errors, p values, structural coefficients, and confidence intervals to nonnormality. The Satorra-Bentler adjustment was again used for the root-mean-square error of approximation (RMSEA SB) and both baseline comparison indexes, the Comparative Fit Index (CFI SB) and the Tucker-Lewis Index (TLI SB). The regular standardized root-mean-square residual (SRMR) was used to evaluate the size of remaining residuals. Following Kline,⁵² acceptable levels were set to nonsignificance for the scaled χ^2 test ($p > 0.05$), RMSEA SB, and SRMR values lower than 0.08, and for CFI SB and TLI SB coefficients above 0.90. The equation-level goodness-of-fit was determined using R^2 coefficients of determination or explained variance for the global model and each equation, as well as multiple correlation indicators (mc) between dependent variables and predictors and mc², the Bentler-Raykov squared multiple correlation coefficients.⁵³

RESULTS

A description of the sample and all relevant study variables are shown in Tables 1a and 1b. Most participants were women

(84%), had children themselves (66%), and averaged 11.5 years of job experience (SD = 9.7).

A total of 35% (SD = 0.48) of respondents indicated that they had received previous professional training on child abuse and neglect issues. Workplace training experience was the most common type of training received (26%, SD = 0.44), followed by continuing education courses (15%, SD = 0.36). Only a small fraction of the sample (9%, SD = 0.28) indicated that their formal education or certification programs included child abuse or neglect as part of the curriculum. Nevertheless, with the exception of only 6 participants, 99% (SD = 0.08) of all respondents were aware that Texas law requires them to report any suspicion of child abuse or neglect.

Optimized Path Diagram: Correlations

The bivariate correlations of all study variables that were included in the final, optimized path diagram are shown in Table 2. Knowledge of the ACE Study¹² showed a moderate positive correlation to all 3 types of child maltreatment education and, most importantly, a moderate to strong positive correlation to the number of CPS referrals, but only a weak positive correlation to the averaged scenario scores. In general, the scenario scores showed only weak positive correlations to all other variables. In contrast, the number of CPS referrals was moderately positively correlated to all training program types, especially to formal education and continuing education programs ($r = 0.34$).

Overall Model Fit of Optimized Path Diagram

Figure 1 and Tables 3 and 4 show the optimized, best-fitting final path diagram to explain the impact of child maltreatment education programs and knowledge

of the ACE Study¹² on the number of CPS referrals and scenario scores. The optimized model shows a very good fit to the data: $\chi^2_{SB}(3) = 3.897, p = 0.273$; RMSEA-SB = 0.017; CFI-SB = 0.995; TLI-SB = 0.982; SRMR = 0.013; AIC (Akaike information criterion) = 11,670.549; BIC (Bayesian information criterion) = 11,789.643. The optimized model was able to reduce prediction error globally by 21% ($R^2 = 0.21$).

Effect Strengths of Optimized Path Diagram

A respondent’s familiarity with the ACE Study¹² had a significant, positive effect on the number of CPS referrals (standardized structural Satorra-Bentler coefficient, $\beta = 0.34$). Nine percent of the variation in the familiarity with ACEs was, in turn, explained by whether the respondent had received any form of child maltreatment-related training or education. The effect of ACEs is pronounced when one looks at workplace training programs. Here, the indirect effect on the number of CPS referrals that is mediated through knowledge about ACEs is almost as strong (standardized indirect Satorra-Bentler coefficient $\beta = 0.037$) as the direct effect (0.041). Correspondingly, the total effect when including knowledge of ACEs ($\beta = 0.078$) was almost double the size than the direct effect alone suggested. Combined, the direct and indirect effects through ACEs of child maltreatment-related training programs are able to reduce prediction error for the number of CPS referrals by 28% ($R^2 = 0.28$).

The impact of the included variables was much more pronounced on the number of CPS referrals than it was on the averaged clinical scenario scores. Here, the model explained only 3% of the variance, and only formal education and certification programs showed a significant direct effect. The standardized Satorra-Bentler coefficient of ACEs on the scenario scores, albeit still significant ($p < 0.01$), was also considerably smaller (Satorra-Bentler $\beta = 0.085$) than that on the number of CPS referrals.

DISCUSSION

The present study demonstrated the impact that training in ACEs has on child maltreatment detection and willingness to report suspected abuse and

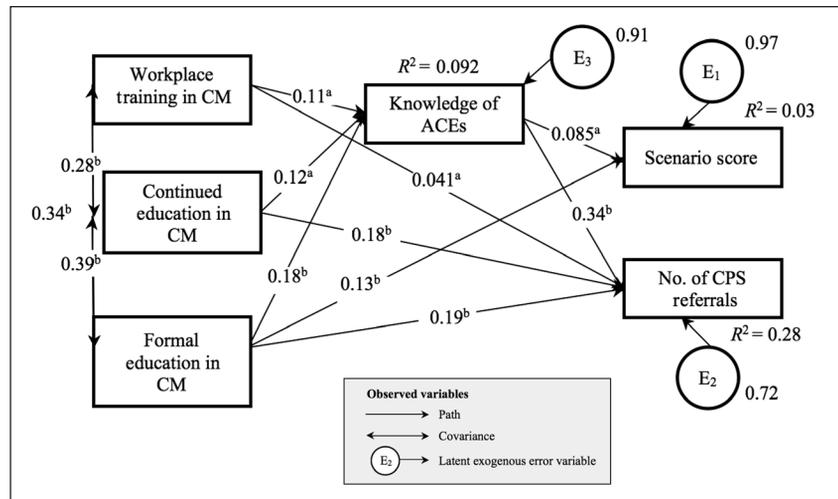


Figure 1. Optimized path diagram with standardized coefficients.

^a $p < 0.01$.

^b $p < 0.001$.

ACEs = adverse childhood experiences; CM = child maltreatment; CPS = Child Protection Services.

neglect to CPS. These findings are aligned with previous research that illustrated the positive impact of abuse training programs in recognition and reporting practices.^{9,11,54,55} Specifically, CME and formal education in ACE awareness and impact asserted a highly significant, positive influence on a sample of health care professionals’ recognition of likely child abuse and reporting practices to CPS. Recognizing the lasting impact of early childhood toxic stress, health professionals who were specifically trained in ACE awareness and screening were the most likely to make referrals to CPS.

Overall, the path diagram demonstrated that all forms of child maltreatment training programs had a highly significant, positive effect on the number of CPS referrals. Furthermore, by isolating the indirect effects that were mediated through knowledge of ACEs, the model also showed that education and training curricula were particularly effective when they informed about ACEs and associated lifelong, detrimental consequences. A comparison of standardized effects of all child maltreatment training program types with knowledge of ACEs identified ACE awareness as the single best predictor for the number of reported cases and 1 of 2 significant predictors for respondents’ scenario scores. The impact of knowledge about ACEs on the number of CPS

referrals was the strongest structural effect in the model. Its standardized Satorra-Bentler coefficient ($\beta = 0.34$) was almost twice as high as the second strongest effect of formal education programs on the number of CPS referrals ($\beta = 0.19$).

Although all effects on the number of total previous CPS referrals were significant, only the effects of child maltreatment training in formal education programs and

Clinical Scenarios for Testing Knowledge of Child Maltreatment

1. Two-year-old with a toxic or foreign body ingestion requiring hospitalization
2. Four-year-old dental patient with a worsening abscess requiring surgery after the mother had failed to administer prescribed antibiotics
3. Two-month-old who “fell off the bed” and has a skull fracture
4. Six-year-old whose mother reports a suspicion of sexual abuse by the father
5. Four-month-old with failure to thrive and lethargy
6. Ten-month-old with a humerus shaft fracture
7. Nine-month-old drowning victim who was taking a bath with a toddler sibling
8. Six-month-old with a small bruise on the ear
9. Four-month-old with one bruise.

Table 3. Structural equation model results^a

Standardized structural coefficient	Satorra-Bentler coefficient	SE	z	p > z	95% CI (coefficient)
Knowledge of ACEs					
Formal education	0.179	0.050	3.57	< 0.001	0.081-0.277
Continuing education	0.118	0.045	2.64	0.008	0.030-0.205
Workplace training	0.106	0.038	2.77	0.006	0.031-0.181
No. of CPS referrals					
Knowledge of ACEs	0.335	0.041	8.23	< 0.001	0.256-0.415
Formal education	0.187	0.044	4.28	< 0.001	0.101-0.272
Continuing education	0.184	0.027	6.75	< 0.001	0.130-0.237
Workplace training	0.041	0.020	2.14	0.032	0.003-0.022
Scenario score					
Knowledge of ACEs	0.085	0.033	2.58	0.010	0.021-0.150
Formal education	0.131	0.032	4.12	< 0.001	0.068-0.193
Covariance (formal education - continuing education)	0.341	0.042	8.05	< 0.001	0.258-0.424
Covariance (formal education - workplace training)	0.276	0.035	7.90	< 0.001	0.207-0.344
Covariance (continuing education - workplace training)	0.393	0.033	11.81	< 0.001	0.328-0.458

^a χ^2 /SB (3) = 3.897, p = 0.273; RMSEA-SB = 0.017; CFI-SB = 0.995; TLI-SB = 0.982; SRMR = 0.013; AIC = 11670.549; BIC = 11789.643.

ACE = adverse childhood experience; AIC = Akaike information criterion; BIC = Bayesian information criterion; CFI = Comparative Fit Index; CI = confidence interval; CPS = Child Protective Services; RMSEA = root-mean-square error of approximation; SB = Satorra-Bentler coefficient; SE = standard error; SRMR = standardized root-mean-square residual; TLI = Tucker-Lewis Index.

Table 4. Structural equation model fit

Equation-level fit	Variance fitted	Variance predicted	Residual	R ²	mc	mc ²
Knowledge of ACEs	0.065	0.006	0.059	0.092	0.303	0.092
No. of CPS referrals	174.995	48.968	126.028	0.280	0.529	0.280
Scenario score	0.245	0.007	0.237	0.030	0.173	0.030

ACE = adverse childhood experience; CPS = Child Protective Services; mc = correlation between dependent variable and its prediction; mc² = Bentler-Raykov squared multiple correlation (N = 1056).

knowledge of ACEs reached significance levels. A likely explanation for this finding is the relatively small amount of variation in this endogenous variable. Most respondents could correctly identify all the clinical scenarios (see Sidebar: Clinical Scenarios for Testing Knowledge of Child Maltreatment) as maltreatment-related injuries and indicated they were very likely to report them (mean = 3.86, SD = 0.49 on a 5-point scale). Future assessments of the clinical scenarios must be operationalized with higher discriminant validity to create more variation between respondents.

The significant and positive structural coefficients between education programs in child maltreatment and the knowledge of ACEs, as well as the medium-strength

correlations between these factors, suggest that ACEs training is already included in some of the existing health curricula. The finding that knowledge of ACEs is the single best predictor for the number of CPS referrals clearly echoes recommendations of researchers and advocates who call for increased training in ACEs and child maltreatment recognition and response in medical school, postgraduate studies, and continuing education.^{6,38} Moreover, it is recommended that not only those in family medicine, pediatrics, and other primary care specialties receive ACE education but also those health care professionals in emergency medicine, psychiatry, internal medicine, and other fields that interact with young children regularly.

CONCLUSION

This study adds to the growing body of literature by examining the direct effect of including child maltreatment education in curricula on recognition and reporting practices and examines how knowledge specifically of ACEs facilitated this impact as a mediating variable. This study showed how education and training in ACEs and child maltreatment made a significant difference in medical professionals' recognition of likely child maltreatment and their willingness to report it to CPS. The importance of continued research into how to best prepare medical practitioners for the detection and reporting of child maltreatment cannot be overstated. Child maltreatment continues to be a major public health problem affecting a reported 683,000 children in the US in 2015, an increase of 3.8% from 2011.⁵⁶ Medical professionals who are most likely to interact with young children are often not trained in ACE awareness, social determinants of health-related toxic stress, and child maltreatment recognition and response, although the need and desire for such training has been documented.¹¹ Because medical practitioners are at the forefront of society's recognition of and fight against child maltreatment, ACEs, and the lasting medical and psychosocial consequences that often plague survivors, it is of paramount importance that they are equipped with the necessary knowledge and training needed to help break the cycle of intergenerational problems one child at a time.

This study is not without limitations. One primary limitation is that the sample of respondents included only those working in one metropolitan community in North Central Texas. This is possibly an unrepresentative sample of medical professionals nationwide. A second limitation is the low variability in the scenario score averages. Future studies should test and validate a more complete ACE detection ability and reporting likelihood scale. The circumstance that this study focused solely on child maltreatment-related ACEs was a probable contributor to the limited variability in this important outcome measure. Respondents in the present study knew they were answering a presurvey for a child-maltreatment training course and,

therefore, likely had reason to assume that the scenarios did constitute instances of child maltreatment. Compounding this potential concern is the circumstance that all scenarios in this survey did in fact constitute actual instances of child maltreatment. By adding scenarios that are not instances of ACEs but, for example, cases of special-needs children who might be mistaken for children with ACEs, the instrument would gain additional discriminant validity and lower the possibility of acquiescence bias.^{57,58} A more comprehensive ACE detection ability and reporting likelihood scale should be established that contains maltreatment experiences as one subscale and measures all other types of non-maltreatment ACE categories (eg, divorce, imprisonment, mental illness) for an improved assessment. Future studies should also more closely assess education and training curricula as well as the centrality of child maltreatment and ACEs in both content modules and examinations. This would enable researchers to produce an even more nuanced assessment of the critical role this knowledge plays in the recognition and reporting of suspected maltreatment. Last, an in-depth examination should be conducted into the specific reasons why, despite the mounting evidence for the importance of ACE information, the inclusion of this topic into educational curricula and certification testing requirements continues to be limited. Such a study could potentially reveal important obstacles and barriers, and might assist in closing the existing gap between educational curricula and the mounting evidence for the importance of more universal ACE training. ❖

Disclosure Statement

The author(s) have no conflicts of interest to disclose.

Acknowledgment

Kathleen Loudon, ELS, of Loudon Health Communications provided editorial assistance.

How to Cite this Article

Bachmann M, Bachmann BA. The case for including adverse childhood experiences in child maltreatment education: A path analysis. *Perm J* 2018;22:17-122. DOI: <https://doi.org/10.7812/TPP/17-122>

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The Successful Teacher

No bubble is so iridescent or floats longer than that blown by the successful teacher.

— William Osler, MD, 1849-1919, physician, pathologist, teacher, diagnostician, bibliophile, historian, classicist, essayist, conversationalist, organizer, manager, and author